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the sensor people

S300
Safety Position Switch

GB 2008/12 607280
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make technical changes

SAFE IMPLEMENTATION AND OPERATION

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1 About this document

1.1 Other applicable documents

The information on the S300 Safety Position Switch is divided into two documents. Document "Application information" contains only the most important safety notices.

↳ For the safe implementation, testing and operation, download document "Safe implementation and operation of the S300" from http://www.leuze.com/s300 or request it from service.schuetzen@leuze.de or tel. +49 8141 5350-111.

Table 1.1: Documents on the S300 Safety Position Switch

Purpose and target group	Title	Source
Detailed information for all users	Safe implementation and operation (this document)	On the Internet, download from: http://www.leuze.com/s300
Basic information for technicians and machine operators	Application information	Print document part no. 607238 included in the delivery contents of the product

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1.2 Used symbols and signal words

Table 1.2: Warning symbols and signal words

	Symbol for dangers
NOTICE	Signal word for property damage Indicates dangers that may result in property damage if the measures for danger avoidance are not followed.
CAUTION	Signal word for minor injury Indicates dangers that may result in minor injury if the measures for danger avoidance are not followed.
WARNING	Signal word for severe injury Indicates dangers that may result in severe or fatal injury if the measures for danger avoidance are not followed.
DANGER	Signal word for life-threatening danger Indicates dangers that will result in severe or fatal injury if the measures for danger avoidance are not followed.

Table 1.3: Other symbols

	Symbol for tips Text passages with this symbol provide you with further information.
	Symbols for action steps Text passages with this symbol instruct you to perform actions.

2 Safety

Before using the Safety Position Switch, a risk evaluation must be performed according to valid standards (e.g. EN ISO 12100-1, EN ISO 13849-1, EN ISO 14121). For mounting, operating and testing, document "Safe implementation and operation of the S300" as well as all applicable national and international standards, regulations, rules and directives must be observed (e.g. machinery directive, low-voltage directive, work-equipment directive, safety regulations, accident-prevention regulations, EN 1088, EN ISO 13849-1, EN 60204-1, EN 954-1). Observe and print out relevant and supplied documents and distribute to the affected personnel.

↳ Before beginning work with the Safety Position Switch, completely read and understand the documents applicable to the respective task.

The following standards apply for the risk evaluation at the protective device prior to using the Safety Position Switch:

- EN ISO 14121, Safety of machinery, risk evaluation
- EN ISO 12100-1, Safety of machinery
- EN ISO 13849-1, Safety-related parts of control systems

The realizable category of the integration in control circuits according to EN ISO 13849-1 and EN 954-1 is dependent on the used contact block and wiring.

In particular, the following national and international legal regulations apply for the start-up, technical inspections and work with Safety Position Switch:

- Machinery directive 2006/42/EC
- Low voltage directive 2006/95/EC
- Use of work equipment directive 89/655 EEC
- Safety regulations
- Accident-prevention regulations and safety rules

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2.1 Proper use

To ensure proper personnel protection, the Safety Position Switch must be mounted, connected and started-up by trained personnel. It must be in perfect condition and inspected regularly. The switching process must only be triggered by an actuator approved for this Safety Position Switch that is form-fitting with positive actuation.

The rules and regulations for protection and safety at work and the recognised safety-related rules and regulations must be observed. These include:

- EN 1088, Interlocking devices associated with guards
- EN ISO 13849-1, Safety-related parts of control systems
- EN 60204-1, Electrical equipment of machines

S300 Safety Switches must be connected in such a way that a dangerous state can only be activated while the protective device is closed and so that the dangerous state stops upon opening of the protective device. It must not be used if the point of operation can be accessed during the lag time before the dangerous state has ended.

Connection conditions:

- the dangerous state can only be activated while the protective device is closed
- opening the protective device while the machine is running triggers a STOP command and ends the dangerous state

Furthermore, the S300 Safety Position Switch must **not** be used under the following conditions:

- the actuation surface (e.g. of the machine or sliding gate) for the actuator is not form-fitting with positive actuation
- rapidly changing ambient temperature (leads to condensation)
- in the event of strong physical shocks
- in explosive or easily flammable atmospheres
- the mounting locations are not sufficiently stable
- the safety of multiple persons is dependent on the function of this Safety Switch (e.g. nuclear power plants, trains, aircraft, motor vehicles, incinerators, medical devices)

For machines with longer slowdowns, a Safety Locking Device must be used.

Handling the Safety Position Switch:

- Observe the permissible environmental conditions for storage and operation (see chapter 14 "Technical data").

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- Immediately replace damaged Safety Position Switch according to these instructions.
- Use cable gland, insulation materials and connecting wires of the appropriate protection rating.
- Protect the Safety Position Switch from penetrating foreign bodies (e.g. shavings, sand and blasting agent).
- Before performing painting work, cover the actuation head, actuator and name plate.
- Immediately clean any contamination from the Safety Position Switch that impacts function according to these instructions.
- Make no structural changes to the Safety Position Switch and/or actuator.
- The switching direction may only be changed following an adequate risk evaluation and according to the dangerous direction of movement.

2.2 Competent personnel

Prerequisites for competent personnel:

- suitable technical training
- knows the rules and regulations for occupational safety, safety at work and safety technology and can assess the safety of the machine
- knows the instructions for the Safety Position Switch and the machine
- was instructed by the responsible individuals on the mounting and operation of the machine and of the Safety Position Switch

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2.3 Responsibility for safety

Manufacturer and operator of the machine must ensure that the machine and implemented Safety Position Switch function properly and that all affected persons are adequately informed and trained.

The type and content of all imparted information must not lead to unsafe actions by users.

The manufacturer of the machine is responsible for:

- safe machine construction
- safe implementation of the Safety Position Switch
- imparting all relevant information to the operator
- adhering to all regulations and directives for the safe starting-up of the machine

The operator of the machine is responsible for:

- instructing the operating personnel
- maintaining the safe operation of the machine
- adhering to all regulations and directives for occupational safety and safety at work
- regular testing by competent personnel

2.4 Exemption of liability

Leuze electronic GmbH + Co. KG is not liable in the following cases:

- Safety Position Switch is not used as intended
- safety notices are not adhered to
- mounting and electrical connection are not properly performed
- proper function is not tested (see chapter 9 "Testing")
- changes to the Safety Position Switch and/or actuator

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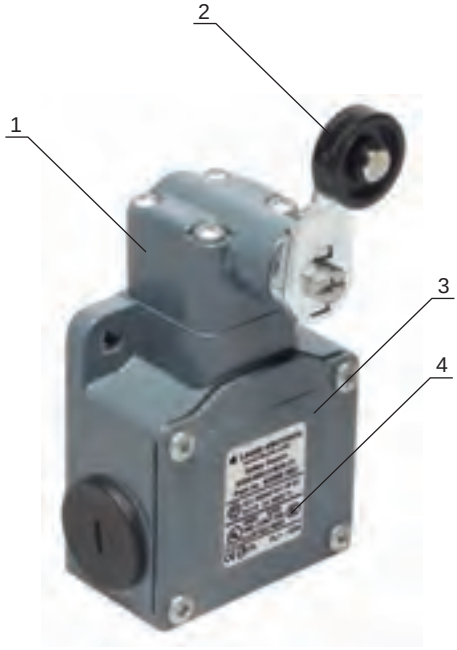
3 Device description

The Safety Position Switch of the S300 series is an electro-mechanical switching device in a housing made of metal; the device satisfies protection rating IP 67. Available as actuator are a roller plunger and a roller lever.



1 Actuator head
2 Actuator
3 Housing cover
4 Name plate (connection data, production code and year of manufacture)

Table 3.1: S300 Safety Position Switch

Article	Part No.	Description
S300-M0C3-M20-15	63000 300	1NC + 1NO, roller plunger, 3 cable entries
S300-M13C3-M20-15	63000 301	2NC + 1NO, roller plunger, 3 cable entries
S300-M0C3-M20-31	63000 302	1NC + 1NO, roller lever, 3 cable entries
S300-M13C3-M20-31	63000 303	2NC + 1NO, roller lever, 3 cable entries

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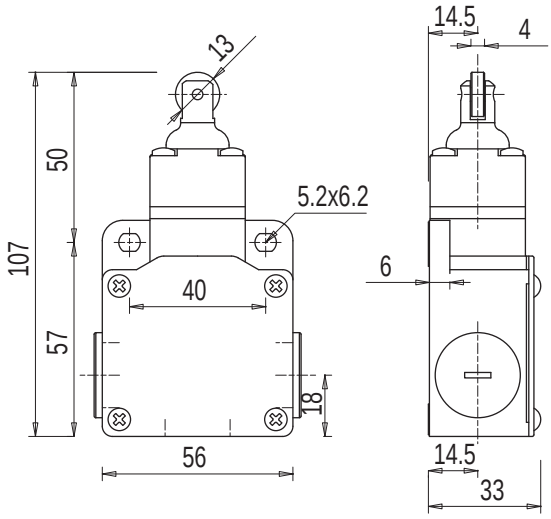

Figure 3.1: Dimensions S300-M0C3-M20-15 and S300-M13C3-M20-15 in mm

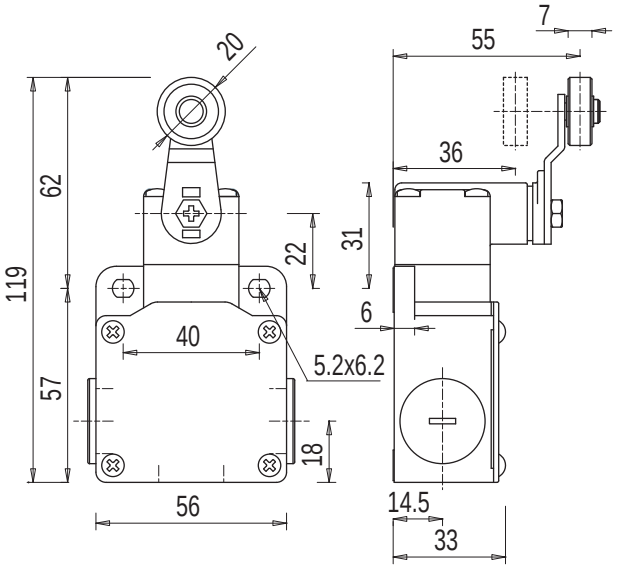

Figure 3.2: Dimensions S300-M0C3-M20-31 and S300-M13C3-M20-31 in mm

The actuator head can be turned in 90° increments and set to 4 approach directions. The roller lever can be mounted with a 180° rotation and can be positioned in 10° increments.

Figure 3.3: Adjustment options

4 Functions

The Safety Position Switch signals to the safety switching device whether the protective device is closed. Depending on actuator and set actuation directions, the Safety Position Switch can also signal alternating directions of danger situations. Release of the actuator closes the safety contacts; pressure on the actuator forces opening of the safety contacts upon opening of the protective device (e.g. a sliding gate). As a result, the machine can only be switched on if the protective device is closed.

5 Applications

The Safety Position Switch is suitable for e.g. the following protective devices:

- turning or sliding protective hoods and protective flaps
- laterally moveable protective gratings or sliding gates
- machine-actuated supplementary cut-off (e.g. in combination with other Safety Switches)

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6 Mounting

WARNING

Serious accidents may result if the Safety Position Switch is not mounted properly!

The protective function of the Safety Position Switch is only ensured if appropriately and professionally mounted for the respective, intended area of application.

- Mounting may only be performed by competent personnel.
- Observe standards, regulations and these instructions.
- Observe mounting conditions exactly.
- Use separate mechanical limit stop (see figure 6.3).
- Set the distances to the actuator and its angles so that it is impossible to circumvent or encompass the protective device.
- Protect the housing from materials penetrating the enclosure (environmental conditions see chapter 14 "Technical data").
- Test to ensure proper function.

6.1 Adjusting the switching and approach direction

- Loosen the 4 screws on the actuator head.

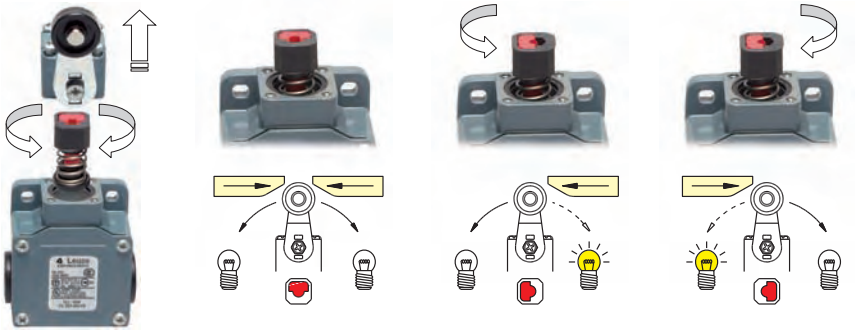
- Lift the actuator head.

WARNING

Severe injuries may result if the switching function is not set properly!

- Set the switching direction so that the NC contacts open upon opening of the protective device.

- If necessary, set the internal plunger to the correct switching direction in 90° increments (relative to the NC contacts).



- Place the actuator head on the Safety Position Switch in the desired approach direction.

- Tighten the 4 screws on the actuator head with 0.8–1.2 Nm.
- If necessary, loosen the screw on the roller lever and adjust the roller lever (rotate 180° and/or turn in 10° increments).
- If necessary, tighten the screw on the roller lever with 0.8–1.2 Nm.

6.2 Mounting the Safety Position Switch

Mounting conditions

The stop command must be triggered through pressure on the Safety Position Switch **upon opening** of the protective device, never by releasing the Safety Position Switch.

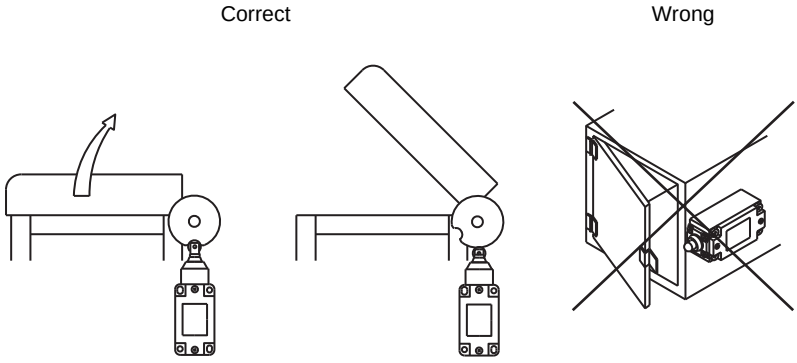


Figure 6.1: Mounting example with a turning protective device

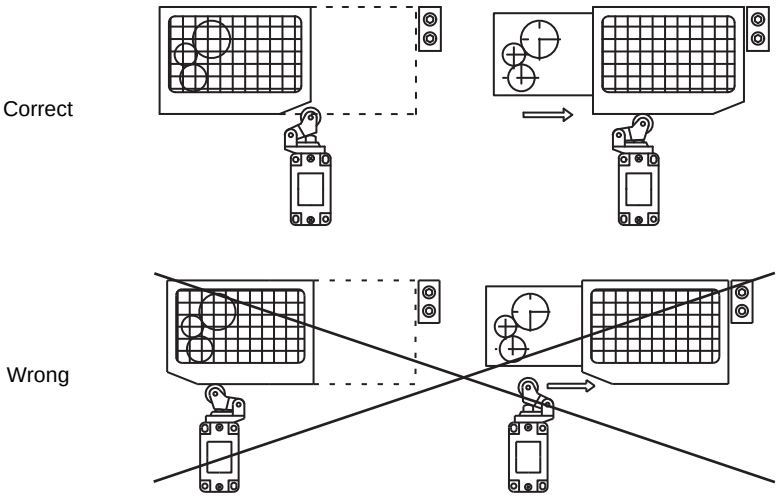


Figure 6.2: Mounting example with a sliding protective device

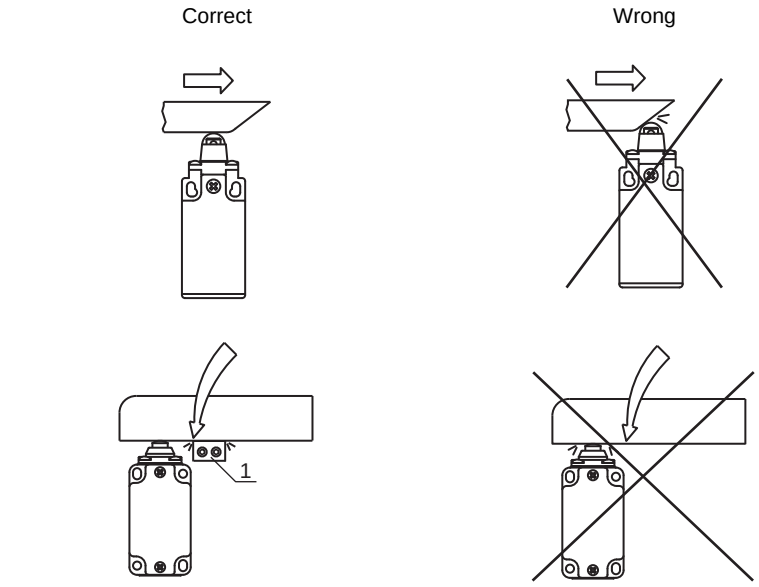


Figure 6.3: Mechanical limit stop (1)

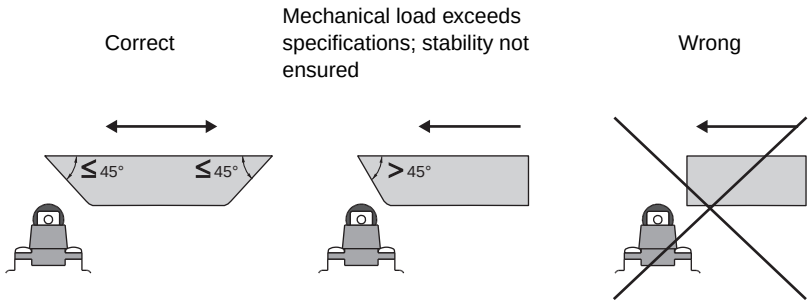
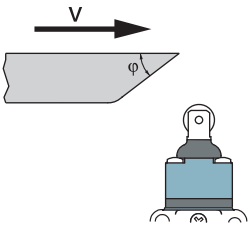


Figure 6.4: Roller plunger actuation

Actuator: roller plunger	j	v_{max} (m/s)	v_{min} (mm/s)	v_{min} (mm/s)
	–	–	S300-M0C3-M20-15	S300-M13C3-M20-15
	15°	1.0	0.04	4.0
	30°	0.5	0.02	2.0
	45°	0.3	0.01	1.0

Correct

Mechanical load exceeds specifications; stability not ensured

Wrong

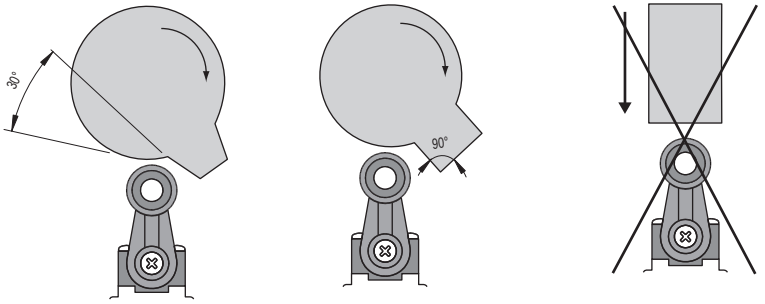
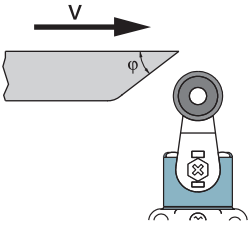


Figure 6.5: Roller lever actuation

Actuator: roller lever	j	v_{max} (m/s)	v_{min} (mm/s)	v_{min} (mm/s)
	–	–	S300-M0C3-M20-31	S300-M13C3-M20-31
	15°	2.5	0.07	9.0
	30°	1.5	0.07	8.0
	45°	1.0	0.07	7.0
	60°	0.75	0.07	7.0

Mounting

Prerequisites for mounting:

- actuation direction is set
- fully assembled

NOTICE
The Safety Position Switch may be damaged if mounted improperly! Safety Position Switch is not suitable for large mechanical loads. ↳ Observe mounting conditions and dimensions exactly. ↳ Mount covers to protect against foreseeable damages.

↳ Select the mounting location so that the following conditions are satisfied:

- should be form-fitting to protect against changes in position; secured mounting is possible
- corresponding actuating element (moveable guard, control cam) is sufficiently secured against changes in position and the actuator is actuated with positive force
- accessible to qualified personnel for testing and replacement

↳ Position washers and screw down Safety Position Switch with 2–3 Nm.

7 Electrical connection

WARNING

Serious accidents may result if the electrical connection is faulty!

↳ Electrical connection may only be performed by competent personnel.

7.1 Connecting the contact block

Prerequisites:

- temperature stability of the cable insulation material must be greater than the maximum temperature of the housing (see chapter 14 "Technical data")
- cable gland with appropriate protection rating
- maximum current load is observed (see chapter 14 "Technical data")

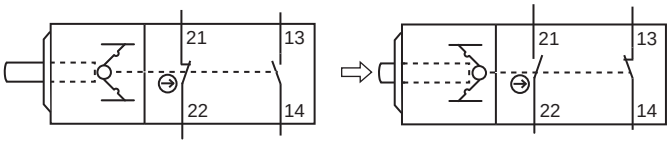


Figure 7.1: 1NC + 1NO (S300-M0C3-M20-15, S300-M0C3-M20-31)

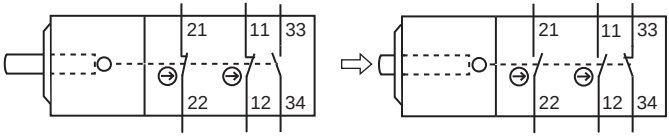


Figure 7.2: 2NC + 1NO (S300-M13C3-M20-15, S300-M13C3-M20-31)

DANGER

Risk of death by electric shock!

↳ Interrupt the voltage supply to the Safety Position Switch.

↳ Unscrew the housing cover.

↳ Connect the contact block according to the circuit diagram.

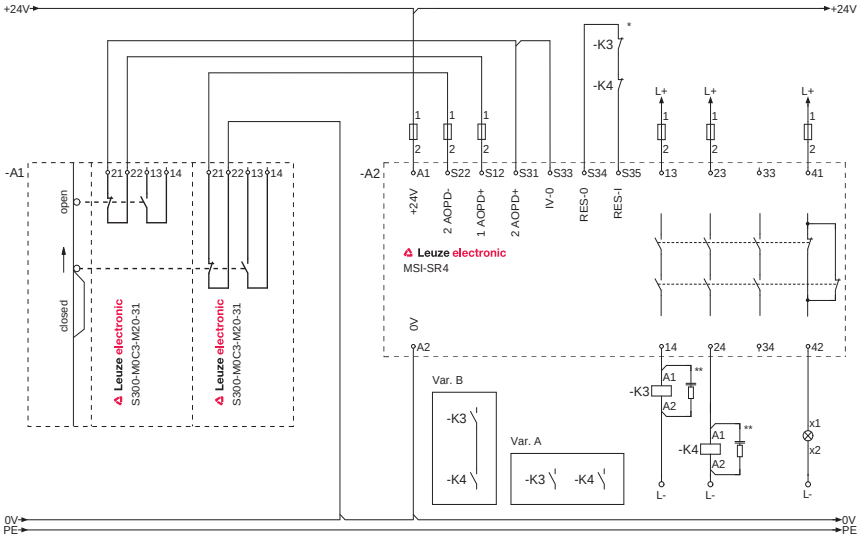


Figure 7.3: Connection example S300-M0C3-M20-15

- Tighten cable terminal screws with 0.6–0.8 Nm.
- Tighten the housing cover with 0.8–1.2 Nm.

8 Setting the device into service

Prerequisites:

- Safety Position Switch is mounted and connected according to these instructions
- operating personnel have been trained in the correct use

- Test the function of the Safety Position Switch (see chapter 9 "Testing").

The Safety Position Switch is then ready for use.

9 Testing

S300 Safety Position Switches are maintenance-free. Nevertheless, they must be replaced after maximum 5,000,000 switching cycles.

- Always replace the entire Safety Position Switch including actuator.
- For the testing intervals, observe nationally applicable regulations.
- Document all tests in a comprehensible manner.

9.1 To be performed prior to the initial start-up by competent personnel

- Check whether the Safety Position Switch is operated according to its specified environmental conditions (see chapter 14 "Technical data").
- Check whether the Safety Position Switch is mounted in a form-fitting manner according to its specifications (see chapter 6.2 "Mounting the Safety Position Switch").
- Test whether the actuator is form-fitting with positive actuation.
- Check whether the switching direction was set correctly and the STOP command is output as soon as opening of the protective device begins.
- Test to ensure proper mechanical and electrical function (see chapter 9.2).

9.2 To be performed periodically by competent personnel

Mechanical function

- Stop the dangerous state and open the protective device.
- Check that the components are securely fastened.
- Test the cable entry for leaks.
- Check Safety Position Switch and actuator for damage, deposits, deformation and wear.
- Manually actuate roller lever or roller plunger (actuator) several times and check for ease of motion.
- Check the actuating surface (e.g. of the machine or sliding gate) for the actuator for wear.
- Test the interaction of the actuation surface and the actuator to ensure that it is form-fitting with positive actuation.

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Electrical function

WARNING

Severe injuries may result if tests are not performed properly!

- Make certain that there are no persons in the danger zone.

- Stop the dangerous state and open the protective device.
- Make certain that the machine cannot be started while the protective device is open.
- Close the protective device and start the machine.
- Test several times whether the machine stops upon opening of the protective device.
- Test whether the dangerous state ends before the point of operation can be reached.

9.3 To be performed daily by the operating personnel

WARNING

Severe injuries may result if tests are not performed properly!

- Make certain that there are no persons in the danger zone.

- Stop the dangerous state and open the protective device.
- Check the Safety Position Switch and actuator for damage or tampering.
- Make certain that the machine cannot be started while the protective device is open.
- Close the protective device and start the machine.
- Test whether the machine stops upon opening of the protective device.

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10 Cleaning

There must be no soiling (e.g. shavings and dust) present, especially in the actuator of the Safety Position Switch.

Prerequisites for cleaning:

- protective device is opened and machine is switched off
- voltage supply to the Safety Position Switch is interrupted

↳ Regularly clean the Safety Position Switch, actuator and actuation surface (e.g. of the machine or sliding gate) (e.g with a vacuum cleaner).

11 Disposing

↳ The nationally valid regulations for electro-mechanical components are to be observed when disposing.

12 Service and support

Contact data:

Leuze electronic GmbH + Co. KG
Liebigstraße 4
D-82256 Fürstenfeldbruck
Phone: +49 8141 5350-111

13 Accessories

There are no accessories available for the Safety Position Switch.

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14 Technical data

Table 14.1: General

Switch type	Interlock device without guard interlocking in accordance with EN 1088
Actuator	Plunger actuator, roller actuator with lever, mounted
Approach actuation directions	Plunger actuator: 1 x above, 4 x side (90°) Roller actuator: 360°, 4 x lateral (90°)
Switching direction of plunger actuator	Both sides
Switching direction of roller actuator	Left-right one side, both sides
Approach speed S300-M0C3-M20-15 with angle of approach = 15°, 30°, 45°	min. 0.04mm/s, 0.02mm/s, 0.01mm/s max. 1.0m/s, 0.5m/s, 0.3m/s
Approach speed S300-M13C3-M20-15 with angle of approach = 15°, 30°, 45°	min. 4.0mm/s, 2.0mm/s, 1.0mm/s max. 1.0m/s, 0.5m/s, 0.3m/s
Approach speed S300-M0C3-M20-31 with angle of approach = 15°, 30°, 45°, 60°	min. 0.07 mm/s max. 2.5m/s, 1.5m/s, 1.0m/s, 0.75m/s
Approach speed S300-M13C3-M20-31 with angle of approach = 15°, 30°, 45°, 60°	min. 9mm/s, 8mm/s, 7mm/s, 7mm/s max. 2.5m/s, 1.5m/s, 1.0m/s, 0.75m/s
Actuating path S300-M0C3-M20-15	4mm
Actuating path S300-M13C3-M20-15	3mm
Actuating path S300-M0C3-M20-31	60°
Actuating path S300-M13C3-M20-31	43°
Actuation force of plunger actuator	min. 11 N
Actuation force of roller actuator	min. 0.1 Nm
Mechanical life time without actuator acc. to IEC 60947-5-1	5,000,000 switching cycles
Actuation frequency acc. to IEC 60947-5-1	max. 3600 per hour
Life time according to EN ISO 13849-1	on request

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Number of cycles before dangerous failure (B10d) according to EN 61810-2 with DC1 (ohmic load) with AC1 (ohmic load) with DC13 (inductive load) with AC15 (inductive load) low load (20% rated load)	on request
Usage category in accordance with EN 60947-5-1	AC 15 (Ue / Ie): 250V / 6A 400V / 4A 500V / 1A DC 13 (Ue / Ie): 24V / 6A 125V / 1.1A 250V / 0.4A
Dimensions (dimensional drawings)	see chapter 3 "Device description"

Table 14.2: Safety

Protection rating	IP 67
Contact protection	grounding
Contact allocation S300-M0C3-M20-15 S300-M0C3-M20-31	1 NC + 1 NO
Contact allocation S300-M13C3-M20-15 S300-M13C3-M20-31	2 NC + 1 NO
Contact material	silver alloy
Switching principle S300-M0C3-M20-15 S300-M0C3-M20-31	snap-action contact
Switching principle S300-M13C3-M20-15 S300-M13C3-M20-31	slow-action contact
Opening of contact	positive-forced

CTi Automation - Phone: 800.894.0412 - Fax: 208.368.0415 - Web: www.ctiautomation.net - Email: info@ctiautomation.net

Rated insulation voltage	500VAC, 600VDC
Conventional thermal current	max. 10A
Short-circuit protection according to IEC 60269-1	10A, 500V, type aM

Table 14.3: Housing

Housing material	metal

Table 14.4: Connection

Number of cable entries	3
Type of cable entry	M20 x 1.5
Conductor cross-section (stranded)	1 x 0.5mm^2 to 2 x 2.5mm^2

Table 14.5: Environment

Temperature range, operation	–25 ... +80°C
Dirt levels, external, in accordance with EN 60947-1	3

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15 EC Declaration of Conformity

Leuze electronic GmbH + Co. KG
Liebigstraße 4
D-82256 Fürstenfeldbruck

We hereby declare that the S300 Safety Position Switch (see name plate for part no.) in the form in which it is marketed by us conforms with the relevant safety and health requirements of the listed EC directives [1] (including all changes) and that the listed standards [1] were used in its design and construction.

Fürstenfeldbruck, 15 September 2008

ppa. Dr. Holger Lehmitz
Director of the Safety Systems Division

ppa. Werner Lehner
Director of Product Management
Safety Systems Division